AMENDMENTS TO THE CLAIMS

The claims in this listing will replace all prior versions, and listings, of claims in the application.

1. (Original) A lens barrel including a rotatable ring rotatable about a rotational axis extending in a direction of an optical axis, an outer annular member which is non-rotatable and supports said rotatable ring inside said outer annular member, and at least one optical element movable along said optical axis by a rotation of said rotatable ring, said lens barrel comprising:

an advancing/retracting mechanism, provided between an outer peripheral surface of said rotatable ring and an inner peripheral surface of said outer annular member, configured to move said rotatable ring along said optical axis between front and rear movement limits of said rotatable ring in said optical axis direction relative to said outer annular member, when said rotatable ring is rotated;

at least one circumferential groove located on one of said inner peripheral surface of said outer annular member and said outer peripheral surface of said rotatable ring; and

at least one rotation-guiding projection located on the other of said inner peripheral surface of said outer annular member and said outer peripheral surface of said rotatable ring,

wherein said at least one rotation-guiding projection is engaged in said at least one circumferential groove such that said rotatable ring is rotatable at an axial fixed position without moving along said optical axis when said rotatable ring is moved to said front movement limit by said advancing/retracting mechanism.

2. (Original) The lens barrel according to claim 1, wherein said at least one rotation-guiding projection and said at least one circumferential groove are formed on said outer peripheral surface of said rotatable ring and said inner peripheral surface of said outer annular

member, respectively.

3. (Original) The lens barrel according to claim 1, wherein said advancing/retracting mechanism comprises:

a male helicoid located on said outer peripheral surface of said rotatable ring; and

a female helicoid located on said inner peripheral surface of said outer annular member, said female helicoid engageable with said male helicoid, wherein said female helicoid and said male helicoid are disengaged from each other when said at least one rotation-guiding projection is engaged in said at least one circumferential groove.

4. (Original) The lens barrel according to claim 3, further comprising at least one non-threaded portion on said one of said inner peripheral surface of said outer annular member and said outer peripheral surface of said rotatable ring, on which said at least one circumferential groove is formed, in an area thereon in which one of said male helicoid and said female helicoid is formed, said non-threaded portion generally extending parallel to threads of said one of said male helicoid and said female helicoid to communicate with said at least one circumferential groove, wherein said at least one rotation-guiding projection is positioned to be associated with said at least one non-threaded portion when said male helicoid and said female helicoid are engaged with each other.

5. (Original) The lens barrel according to claim 4, wherein an amount of projection of said at least one rotation-guiding projection in a radial direction is greater than a tooth depth of said one of said male helicoid and said female helicoid, and

wherein said at least one non-threaded portion comprises at least one inclined groove extending generally parallel to said threads of said one of said male helicoid and said female helicoid, said at least one inclined groove communicating with said at least one circumferential

groove, said at least one rotation-guiding projection entering said at least one inclined groove when said male helicoid and said female helicoid are engaged with each other.

6. (Original) The lens barrel according to claim 5, wherein said at least one rotation-guiding projection comes into contact with one of two opposed surfaces in said at least one inclined groove such that said male helicoid and said female helicoid are engaged with each other by a relative sliding movement between said at least one rotation-guiding projection and said one of two opposed surfaces, when said at least one rotation-guiding projection is moved from said circumferential groove to said inclined groove by a rotation of said rotatable ring.

7. (Original) The lens barrel according to claim 3, wherein said at least one rotation-guiding projection and said at least one circumferential groove are located in front of said male helicoid and said female helicoid in said optical axis direction on said outer peripheral surface of said rotatable ring and said inner peripheral surface of said outer annular member, respectively.

8. (Original) The lens barrel according to claim 1_p wherein said at least one rotation-guiding projection comprises a plurality of rotation-guiding projections located at different circumferential positions, and

wherein said circumferential groove comprises a plurality of circumferential grooves located at different circumferential positions.

9. (Original) The lens barrel according to claim 1, further comprising:

a linearly movable ring configured to be guided linearly along said optical axis and moved together with said rotatable ring along said optical axis, while allowing said rotatable ring to rotate relative to said linearly movable ring;

a cam ring rotatable together with said rotatable ring, and including at least one cam groove configured to move said at least one optical element along said optical axis by rotation of

said cam ring; and

a cam-ring guide, located between said linearly movable ring and said cam ring, configured to move said cam ring along said optical axis relative to said linearly movable ring by said rotation of said cam ring when said rotatable ring performs said advancing/retracting operation via said advancing/retracting mechanism, and configured to rotate said cam ring at an axial fixed position without moving said cam ring along said optical axis relative to said linearly movable ring when said rotatable ring performs said fixed-position rotating operation.

10. (Original) The lens barrel according to claim 1, wherein said optical element comprises at least two optical elements movable along said optical axis while changing a distance therebetween and varying a focal length by said rotation of said rotatable ring.

11. (Original) The lens barrel according to claim 3, wherein said rotatable ring comprises a circumferential gear formed on threads of said male helicoid, and

wherein said lens barrel further comprises a drive gear supported by said outer annular member and rotatable about an axis of said drive gear, said drive gear remaining in mesh with said circumferential gear so as to rotate said rotatable ring when said rotatable ring performs one of said advancing/retracting operation via said male helicoid and said female helicoid and said fixed-position rotating operation via said rotation-guiding projection and said circumferential groove.

12. (Original) The lens barrel according to claim 11,

wherein said at least one rotation-guiding projection and said at least one circumferential groove are located on said outer peripheral surface of said rotatable ring and said inner peripheral surface of said outer annular member, respectively, and

wherein said drive gear is supported by said outer annular member and is rotatable on

an axis of said drive gear at a position different from a position of said circumferential groove in said optical axis direction.

13. (Original) The lens barrel according to claim 12, further comprising at least one non-threaded portion on said inner peripheral surface of said outer annular member, in an area thereon in which and said female helicoid is located,

wherein said at least one non-threaded portion extends generally parallel to threads of said female helicoid and communicates with said at least one circumferential groove,

wherein said rotation-guiding projection is associated with said at least one non-threaded portion when said male helicoid and said female helicoid are engaged with each other, and

wherein said drive gear is supported by said outer annular member and is rotatable at a position different from a position of said at least one non-threaded portion in a circumferential direction of said outer annular member.

14. (Original) The lens barrel according to claim 1, wherein said lens barrel is incorporated in a camera, and

wherein said outer annular member comprises a stationary barrel fixed to a camera body of said camera.

15. (Original) A lens barrel including a rotatable ring rotatable about a rotational axis extending in a direction of an optical axis, an outer annular member which is non-rotatable and supports said rotatable ring inside said outer annular member, and at least one optical element which moves along said optical axis by a rotation of said rotatable ring, said lens barrel comprising:

a male helicoid located on an outer peripheral surface of said rotatable ring;

a female helicoid located on an inner peripheral surface of said outer annular member to be engageable with said male helicoid, wherein said female helicoid and said male helicoid are engaged with and disengaged from each other in accordance with variations in relative position in said optical axis direction between said rotatable ring and said outer annular member;

at least one circumferential groove located on one of said inner peripheral surface of said outer annular member and said outer peripheral surface of said rotatable ring, at a position different from positions of said male helicoid and said female helicoid in said optical axis direction; and

at least one rotation-guiding projection located on the other of said inner peripheral surface of said outer annular member and said outer peripheral surface of said rotatable ring at a position different from said positions of said male helicoid and said female helicoid in said optical axis direction and slidably engageable in said at least one circumferential groove,

wherein said at least one rotation-guiding projection is disengaged from said at least one circumferential groove such that said rotatable ring performs an advancing/retracting operation in which said rotatable ring moves along the optical axis direction while rotating relative to said outer annular member due to engagement of said male helicoid with said female helicoid, when said rotatable ring is positioned relative to said outer annular member in said optical axis direction so that said male helicoid and said female helicoid are engaged with each other, and

wherein said rotation-guiding projection is engaged in said circumferential groove such that said rotatable ring performs a fixed-position rotating operation in which said rotatable ring rotates at an axial fixed position without moving along said optical axis relative to said outer annular member, when said rotatable ring is positioned relative to said outer annular member in said optical axis direction so that said male helicoid and said female helicoid are disengaged

from each other.

16. (Original) A lens barrel including a rotatable ring rotatable about a rotational axis extending in a direction of an optical axis, an outer annular member which is non-rotatable and supports said rotatable ring inside said outer annular member, and at least one optical element which moves along said optical axis by a rotation of said rotatable ring, said lens barrel comprising:

a male helicoid located on an outer peripheral surface of said rotatable ring;

a female helicoid located on an inner peripheral surface of said outer annular member to be engageable with said male helicoid, wherein said female helicoid and said male helicoid are engaged with and disengaged from each other in accordance with variations in relative position in said optical axis direction between said rotatable ring and said outer annular member;

at least one circumferential groove located on said inner peripheral surface of said outer annular member at a position different from a position of said female helicoid in said optical axis direction;

at least one rotation-guiding projection located on said outer peripheral surface of said rotatable ring at a position different from a position of said male helicoid in said optical axis direction and slidably engageable in said at least one circumferential groove, wherein said at least one rotation-guiding projection is disengaged from said at least one circumferential groove when said male helicoid and said female helicoid are engaged with each other, and wherein said at least one rotation-guiding projection is engaged in said at least one circumferential groove when said male helicoid and said female helicoid are disengaged from each other;

a circumferential gear located on said outer peripheral surface of said rotatable ring at a position different from a position of said rotation-guiding projection in said optical axis

direction; and

a drive gear supported by said outer annular member and rotatable on an axis of said drive gear, and which remains in mesh with said circumferential gear and is configured to rotate said rotatable ring in one of the case where said male helicoid and said female helicoid are engaged with each other and the case where said at least one rotation-guiding projection is engaged in said at least one circumferential groove,

wherein said drive gear is supported by said outer annular member and is rotatable at a position different from a position of said at least one circumferential groove in said optical axis direction.

17. (Original) The lens barrel according to claim 16, further comprising at least one non-threaded portion on said inner peripheral surface of said outer annular member in an area thereon in which and said female helicoid is formed, wherein said at least one non-threaded portion extends generally parallel to threads of said female helicoid and is configured to communicate with said at least one circumferential groove,

wherein said at least one rotation-guiding projection is configured to be associated with said at least one non-threaded portion when said male helicoid and said female helicoid are engaged with each other, and

wherein said drive gear is supported by said outer annular member and is rotatable at a position different from position of said non-threaded portions in a circumferential direction of said outer annular member.

18. (Original) The lens barrel according to claim 17, wherein said at least one rotation-guiding projection comprises a plurality of rotation-guiding projections formed on said outer peripheral surface of said rotatable ring at different circumferential positions thereon,

wherein said at least one circumferential groove comprises a plurality of circumferential grooves located on said inner peripheral surface of said outer annular member at different circumferential positions thereon,

wherein said at least one non-threaded portion comprises a plurality of non-threaded portions located on said inner peripheral surface of said outer annular member at different circumferential positions thereon, and

wherein said drive gear is positioned between two adjacent non-threaded portions of said plurality of non-threaded portions in a circumferential direction of said outer annular member.

19. (Original) The lens barrel according to claim 18, wherein an amount of projection of each of said plurality of rotation-guiding projections in a radially outward direction is greater than a tooth depth of said male helicoid, and

wherein said plurality of non-threaded portions comprises a plurality of inclined grooves, respectively, which extend parallel to said threads of said female helicoid, wherein said plurality of rotation-guiding projections enter said plurality of inclined grooves, respectively, when said male helicoid and said female helicoid are engaged with each other.

20. (Original) The lens barrel according to claim 16, wherein said circumferential gear is formed on threads of said male helicoid.

21. (Original) The lens barrel according to claim 16, wherein said optical element comprises at least two optical elements movable along said optical axis while changing a distance therebetween and varying a focal length by said rotation of said rotatable ring.

22. (Original) The lens barrel according to claim 16, wherein said lens barrel is incorporated in a camera, and

wherein said outer annular member comprises a stationary barrel fixed to a camera body of said camera.

23. (New) A retractable zoom lens barrel for a zooming optical system, the retractable lens barrel being movable in an optical axis direction between a retractable lens barrel retracted position and a retractable lens barrel extended position, comprising:

a first rotatable barrel supported by a cylindrical housing, such that:

said first rotatable barrel rotates while moving in the optical axis direction when said first rotatable barrel moves between a first rotatable barrel retracted position and a first rotatable barrel extended position; and

said first rotatable barrel rotates without moving in the optical axis direction when said first rotatable barrel is in the first rotatable barrel extended position; and

a second rotatable barrel movable relative to said first rotatable barrel, such that:

said second rotatable barrel rotates while moving in the optical axis direction when said second rotatable barrel moves between a second rotatable barrel retracted position and a second rotatable barrel extended position; and

said second rotatable barrel rotates without moving in the optical axis direction when said second rotatable barrel is in the second rotatable barrel extended position,

wherein:

the amount of movement in the optical axis direction of the second rotatable barrel is greater than that of the first rotatable barrel when said first and second rotatable barrels rotate while moving in the optical axis direction,

the rotation of said first and second rotatable barrels when moving in the optical axis direction causes the retractable lens barrel to move from the retractable lens barrel retracted position to the retractable lens barrel extended position, and

the rotation of the first and the second rotatable barrels in the respective first rotatable barrel extended position and second rotatable barrel extended position effects a zooming operation of the zooming optical system.

24. (New) The retractable zoom lens barrel according to claim 23, wherein the retractable zoom lens barrel is configured to be used with a digital camera.

25. (New) The retractable zoom lens barrel according to claim 23, wherein no image can be taken in the retractable lens barrel retracted position

26. (New) A digital camera comprising a body and a lens barrel, the lens barrel housed within the body and including a rotatable ring rotatable about a rotational axis extending in a direction of an optical axis, an outer annular member which is non-rotatable and supports said rotatable ring inside said outer annular member, and at least one optical element movable along said optical axis by a rotation of said rotatable ring, said lens barrel comprising:

an advancing/retracting mechanism, provided between an outer peripheral surface of said rotatable ring and an inner peripheral surface of said outer annular member, configured to move said rotatable ring along said optical axis between front and rear movement limits of said rotatable ring in said optical axis direction relative to said outer annular member, when said rotatable ring is rotated;

at least one circumferential groove located on one of said inner peripheral surface of said outer annular member and said outer peripheral surface of said rotatable ring; and

at least one rotation-guiding projection located on the other of said inner peripheral

surface of said outer annular member and said outer peripheral surface of said rotatable ring,

wherein said at least one rotation-guiding projection is engaged in said at least one circumferential groove such that said rotatable ring is rotatable at an axial fixed position without moving along said optical axis when said rotatable ring is moved to said front movement limit by said advancing/retracting mechanism.

27. (New) The camera according to claim 26, wherein said at least one rotation-guiding projection and said at least one circumferential groove are formed on said outer peripheral surface of said rotatable ring and said inner peripheral surface of said outer annular member, respectively.

28. (New) The camera according to claim 26, wherein said advancing/retracting mechanism comprises:

a male helicoid located on said outer peripheral surface of said rotatable ring; and

a female helicoid located on said inner peripheral surface of said outer annular member, said female helicoid engageable with said male helicoid, wherein said female helicoid and said male helicoid are disengaged from each other when said at least one rotation-guiding projection is engaged in said at least one circumferential groove.

29. (New) The camera according to claim 26, wherein said at least one rotation-guiding projection comprises a plurality of rotation-guiding projections located at different circumferential positions, and

wherein said circumferential groove comprises a plurality of circumferential grooves located at different circumferential positions.

30. (New) The camera according to claim 26, further comprising:

a linearly movable ring configured to be guided linearly along said optical axis and

moved together with said rotatable ring along said optical axis, while allowing said rotatable ring to rotate relative to said linearly movable ring;

a cam ring rotatable together with said rotatable ring, and including at least one cam groove configured to move said at least one optical element along said optical axis by rotation of said cam ring; and

a cam-ring guide, located between said linearly movable ring and said cam ring, configured to move said cam ring along said optical axis relative to said linearly movable ring by said rotation of said cam ring when said rotatable ring performs said advancing/retracting operation via said advancing/retracting mechanism, and configured to rotate said cam ring at an axial fixed position without moving said cam ring along said optical axis relative to said linearly movable ring when said rotatable ring performs said fixed-position rotating operation.

31. (New) The camera according to claim 26, wherein said optical element comprises at least two optical elements movable along said optical axis while changing a distance therebetween and varying a focal length by said rotation of said rotatable ring.

32. (New) The camera according to claim 26, wherein said outer annular member comprises a stationary barrel fixed to said body of the camera.